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MANUFACTURE OF A SEMICONDUCTOR DEVICE
[Handoutaisouchi No Seizouhouhou]

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[Claims] /*

[Claim 1] A manufacturing method for the manufacture of semiconductors comprising

a process for forming a silicon oxide film and silicon nitride film on top of a semiconductor substrate;

a process for eliminating by sputtering the silicon nitride film on top of an element isolation region;

a process for injecting ions for preventing field reversal and injecting oxygen or silicon ions; and

a process for forming a field oxide film.

[Detailed Description of the Invention]

[0001] [Industrial Field of the Invention]

This invention is related to element isolation technology.

[0002] [Prior Art]

Figure 2 shows a process formation diagram for element isolation regions. 1 denotes a silicon substrate, 2, a silicon oxide film, 3, a silicon nitride film, 4, an ion injection layer for field reversal prevention, and 5, a filed oxide film.

[0003] Next, an explanation is given for a manufacturing process.

[0004] First, after depositing the silicon oxide film 2 and silicon nitride film 3 on top of the silicon substrate 1, by a sputtering and an etching process, the silicon nitride film 3 which will become an element isolation region is eliminated (Figure 2(a)).

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* Claim and paragraph numbers correspond to those in the foreign text.

[0005] Next, boron ion injection is performed for field reversal prevention (Figure 2(b)), and by localized oxidation at 1050-1100 °C in a wet atmosphere, the field oxide film 5 of film thickness 5000 Å is formed (Figure 2(c)), and afterward, the silicon nitride film 3 is eliminated (Figure 2(d)).

[0006] [Problems that the Invention is to Solve]

When using the previously described process, when performing localized oxidation, a high degree of thermal processing is required. Because of this requirement, bird's peaks occur, and from these peaks, element isolation regions are formed that differ from desired shapes. In addition, because variations in the concentration of the ion injection region 4 for field reversal prevention and bird's peaks steps occur, the fineness and flatness of the element isolation regions produced are constrained.

[0007] [Means of Solving the Problems]

This invention's manufacturing method for semiconductors comprises

a process for forming a silicon oxide film and silicon nitride film on top of a semiconductor substrate;

a process for eliminating by sputtering the silicon nitride film on top of an element isolation region;

a process for injecting ions for preventing field reversal and injecting oxygen or silicon ions; and

a process for forming a field oxide film.

[0009] Using the processes with previously described structures, through the ion injection of oxygen or silicon, by making the silicon crystal amorphous, and using thermal processing at a lower temperature than the process which oxidizes conventional silicon crystals, it is possible to form a field oxide film 5. In addition, it is possible to make the direction of the film thickness of the lower part of the field oxide film 5 thicker than the top part of the filed oxide film 5 as measured above the silicon substrate 1's surface.

[0010] In addition, when ion injecting oxygen, in order that the oxygen ions work as an oxygen promotion agent, compared to injection silicon ions, it is possible to form a field oxide film 5 using a lower temperature thermal process.

[0011] [Embodiments]

Below, a detailed explanation of this invention is given based on one embodiment.

[0012] Figure 1 shows a manufacturing process diagram of one embodiment of this invention. In the figure, 1 denotes the silicon substrate, 2, the silicon oxide film, 3, the silicon nitride film, 4, the ion injection layer, and 5, the field oxide film.

[0013] Next, an explanation is given for the manufacturing process. First, using conventional technology, after depositing the silicon oxide film 2 and the silicon nitride film 3 on top of the silicon substrate 1, the part of the silicon nitride film 3 which is

to become an element isolation region is eliminated by a sputtering and etching method (Figure 1(a)).

[0014] Next, after injecting boron ions for preventing field reversal, using a dose amount on the order of 10^{16} ions/cm^2, ion injection of oxygen or silicon is performed at an acceleration energy of 100-200 KeV, and in a wet atmosphere, by localized oxidation at 900-950 °C, a filed oxide film 5 of film thickness 5000 Å is formed (Figure 1(c)), and afterward, the silicon nitride film 3 is eliminated (Figure 1(d)).

[0015] This invention, before the localized oxidation process, performs ion injection of oxygen or silicon, achieving the same effect as performing ion injection of oxygen or silicon before the boron ion injection process, used for preventing field reversal. In addition, no limitation exists for the previously described embodiment.

[0016] [Effect of the Invention]

As explained above, as explained in detail, by using this invention, because the field oxide film is formed using a thermal process at a lower temperature than those employed with conventional processes, the concentration distribution of the field reversal prevention layer becomes uniform, and it is possible to control shift from bird's peaks. Refined processing of the field oxide film becomes possible and in addition, because the thickness direction of the lower field oxide film become thicker than the film thickness of the

top part of the field oxide film above the silicon substrate surface, it becomes possible to flatten the field oxide film.

[Brief Explanation of the Drawings]

[Figure 1] A manufacturing process diagram for one embodiment of this invention.

[Figure 2] A manufacturing process diagram for conventional field oxide films.

[Explanation of the Elements]

1 Silicon substrate

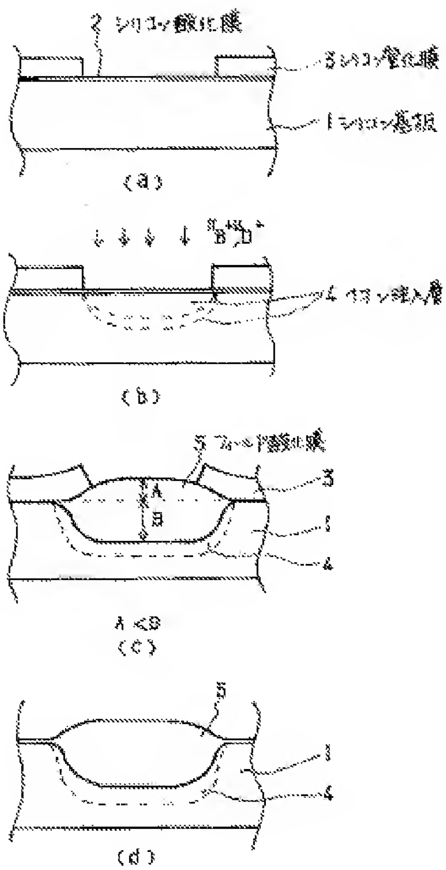
2 Silicon oxide film

3 Silicon nitride film

4 Ion injection region

5 Field oxide film

[Figure 1]



2- Silicon oxide film
3- Silicon nitride film
1- Silicon substrate

4- Ion injection layer

5- Field oxide film

[Figure 2]